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G74-154 Mosquito Control Guide (Revised March 1996)

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NebGuide

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Mosquito Control Guide

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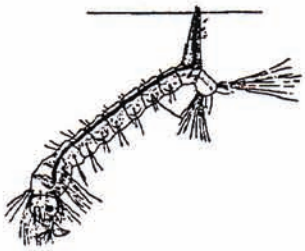
The life cycle, control, and impact of mosquitoes common to Nebraska are discussed.

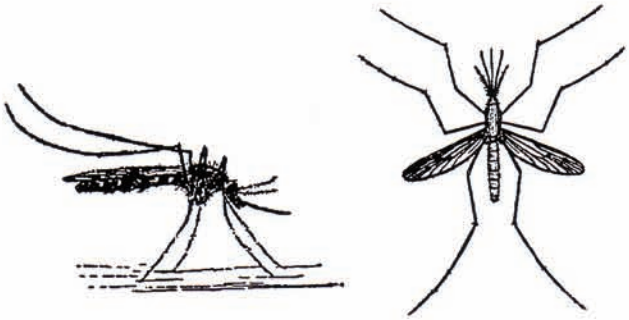
Mosquitoes are insects belonging to the order Diptera, the same one as flies. Worldwide there are over 3,000 species of mosquitoes, 150 of which are found in the United States. In Nebraska there are fewer than a dozen important species. Distribution of mosquitoes ranges from the Arctic to the Tropical Rain Forests.

Historically mosquitoes are one of the most important insects encountered by man because they are vectors of human diseases such as malaria (protozoa), filariasis (nematodes), yellow fever, dengue fever, and the encephalitis viruses. It has been estimated that half of all human deaths prior to 1950 (the dawn of miracle insecticides) resulted from mosquito-transmitted diseases. Disease transmission by mosquitoes is termed "biological transmission" because the disease organisms multiply and complete some or all of their life cycle within the mosquito.



A. Larvae (wigglers) stage.

B. Pupa (tumbler) stage.



C. Adult mosquito.

Life Cycle

Eggs from most mosquito species are deposited singly or in rafts in or near water. Eggs of some floodwater mosquitoes can remain viable for one to three years without water. *Aedes vexans*, a daytime feeder common to Nebraska, is an example. In contrast, *Culex tarsalis* eggs hatch within a couple of days. These two species also differ in overwintering; *C. tarsalis* overwinters as a fertilized hibernating female while *A. vexans* overwinters as an egg.

The larvae (wigglers) of most species have a prominent breathing siphon. The larvae rest suspended diagonally from the water surface with the end of the siphon penetrating the surface. A few species can remain under water obtaining oxygen by diffusion through their "skin", and some have short sharp siphons that pierce the stems of aquatic plants where they obtain air. Larvae feed on microscopic organisms in the water. Larvae molt four times and transform to the pupa stage ("tumbler") at the last molt. The larval stage may last a week or longer, but the pupal stage usually lasts only two or three days before the adult mosquito emerges.

When disturbed, mosquito larvae dive for deeper water and move by flexing their bodies, a habit which has earned them the label "wiggler". Pupae tumble by rotating the head and tail region as they move to the safety of deeper water.

Adult mosquitoes mate as they fly in swarms. Fertilized females seek a blood meal which is needed for egg maturation. Most species feed on either warm or cold-blooded animals and birds are often the host. Birds also may be a reservoir for some of the encephalitis and avian malarial disease agents.

Male mosquitoes feed on nectar. Mosquitoes probably live only about two weeks. In Nebraska some species will develop several generations per year while others may have only one.

In Nebraska, *A. vexans*, *A. dorsalis*, *A. nigromaculis*, *Culex tarsalis*, and *Culiseta inornata* are the most numerous mosquitoes. Of these, *C. tarsalis* is probably the most important because it is an efficient vector of encephalitis. The Asian Tiger mosquito (*A. albopictus*), also an efficient disease vector, has recently been introduced into Nebraska. Its establishment status is still unclear.

Encephalitis is generally involved in a mosquito-bird cycle with both hosts serving as reservoirs, but humans or horses may be accidental end points with occasionally serious consequences. Western Equine encephalitis (WEE) and St. Louis encephalitis (SLE) are the two strains found in Nebraska. Generally, encephalitis is clinically inapparent. Clinical signs include fever, and a severe headache, often followed by rapid complete recovery. Older people, however, may have a high fever, nausea, vomiting, chills, severe headache, convulsions, speech problems, confusion, and drowsiness. Small children are more likely to suffer severe consequences with WEE while older people are more likely to suffer a grave illness with SLE. Recovery is often dramatically rapid without complications. However, in a few patients, weakness, dulled mentality, and paralysis may be side effects. In rare cases, death may occur. Positive diagnosis can only be made serologically or by recovery of the virus.

Heartworm disease of dogs, caused by *Dirofilaria immitis*, is also transmitted by mosquitoes. Adult worms live in the heart and pulmonary arteries. High numbers may form tangled knots leading to embolism, asphyxia, or heart dilation, killing the dog. Many species of mosquitoes can carry and transmit this filariasis, but it is most prevalent in the southeast, east, and midwest. The worms can be controlled with drugs administered by veterinarians. However, the dead parasites can clog the pulmonary vessels, killing the animal. In heartworm endemic areas, dogs can be put on a heartworm preventative program under the supervision of a veterinarian.

Control

Mosquitoes probably can't be controlled in an outbreak situation such as flooding, but everyone can help limit mosquito breeding and take measures to reduce mosquito feeding on them and their families. Standing water around the home, in leaf-clogged gutters, wading pools, bird baths, ditches, and low areas in alleys should be drained. Screens covering windows and doors should be in good repair.

Outdoor activities in the evening when mosquitoes are present should be curtailed. If outdoor activities are necessary, wear light-colored clothing (which is less attractive to mosquitoes) that covers most of the skin. Repellents containing DEET, actually (n,n-diethyl-m toluamide), can be used on exposed skin or clothing. However, some people, especially small children, may be sensitive to repellents. Permethrin, a synthetic pyrethroid insecticide which repels and kills mosquitoes, has been incorporated into military and sports clothing and mosquito netting.

Insecticides (diazinon and chlorpyrifos [Dursban]) can be used as residual sprays for mosquitoes that rest in shrubs, flowers, and trees. Check labels for rates and plant phytotoxicity. There also are insecticide treatments for immature mosquitoes in the aquatic habitat. These can be applied as granules, pellets, briquets, or sprays. Some are standard organophosphate or petroleum insecticides. Others are classified as biologicals and would include a strain of the bacterium *Bacillus thuringiensis*. Methoprene, a juvenile hormone which interferes with the transformation from the juvenile to adult life stage, and dimilin, which interferes with chitin formation which hardens the exoskeleton of the insect after it molts also are considered biologicals. There are also mosquito feeding fish (Gambusia) that can be released in mosquito-infested water. Generally these fish do not survive Nebraska winters so releases must be made annually.

Insecticides also are registered for the control of adult mosquitoes. Generally these are applied by aircraft, mist blowers, and foggers. Most insecticide control methods are best used by trained professionals employed in mosquito control districts or municipalities.

A mosquito control guide for towns, municipalities, and public health services is beyond the scope of this publication. The main thrust should be to reduce the breeding source, which requires engineering technology, often heavy equipment and easements. Mosquito control crews need training in mosquito surveys, taxonomy, and in control tactics for immature and adult mosquitoes. Many municipalities have stopped mosquito control programs because of cost, particularly for liability insurance.

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